

Interactions of inorganic nitrogen species with transition metal minerals

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Little is known about the early Earth's nitrogen cycle. It is thought that some production of oxidized species, such as NO, N₂O and NO₂, were generated within the atmosphere from high-energy processes and subsequently reduced to ammonium in a variety of environments. In addition, mineral catalyzed reduction of N₂ within the deep earth has also been suggested as a source of reduced N to the prebiotic Earth. The fates of these compounds within the Earth are not well understood. We have conducted a series of high-pressure (0.5 to 5 kBar) moderate temperature (150-300°C) experiments to investigate potential reactions between ammonium, nitrate (NO₃⁻) and nitrite (NO₂⁻) and iron, nickel and copper sulfides and oxides. Ammonium was found to be stable under all conditions investigated, even in the presence of mineral oxides, but nitrate and nitrite exhibited complex reaction kinetics and pressure responses. This data as well as isotopic fractionation factors observed during hydrothermal nitrate and nitrite reduction will be discussed.